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Impact of Higher-Resolution Meteorological Data on ARAC Predictions During ETEX

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ABSTRACT

The European Tracer Experiment (ETEX) consisted of two principal phases. In the real-time phase, participants made predictions of the concentration of a released gas at many locations across Europe, acting in a simulated emergency response mode. Each participant used whatever available sources of meteorological data they considered appropriate. For the second phase, all participants used analyzed gridded data from a European Centre for Medium-Range Weather Forecasts (ECMWF) model. In addition, participants were free to use other data sources as well.

The Atmospheric Release Advisory Capability (ARAC) participated in both phases of ETEX. For the real-time phase, ARAC based its calculations solely on analysis and forecast gridded data from the Navy Operational Global Atmospheric Prediction System (NOGAPS) model. The NOGAPS data were provided at 2.5 deg horizontal resolution, at the standard pressure levels (providing only 3 levels within the model domain), at 12 hr intervals. The NOGAPS forecasts were quite accurate, based on comparison of forecasts with subsequent analyses, but the relatively coarse resolution of the data limited the accuracy of our predictions.

The ECMWF data used in the second phase of ETEX were provided at 0.5 deg horizontal resolution, with 7 or 8 vertical levels within the model domain, at 6 hr intervals. ARAC based its second phase calculations solely on the ECMWF data. The higher resolution of the ECMWF data resulted in markedly improved results.

In the real-time phase, ARAC used its Gradient ADPIC dispersion model. For the second phase we used the new Random Displacement Method (RDM) for the diffusion calculation within the ADPIC model framework. Both models solve the advection-diffusion equation, in the case of Gradient ADPIC with a hybrid Eulerian-Lagrangian particle-in-cell method, and for RDM ADPIC with a Lagrangian, Monte-Carlo method.

For the second phase of ETEX, ARAC used ECMWF temperature and wind data to analyze appropriate values of mixing layer height and stability parameters, something we were unable to accomplish for the real-time phase. As a result of this analysis we used lower mixing layer heights during the second phase. The released gas was therefore more likely to be constrained to the lower levels of the model domain, where noticeably different wind directions and speeds were observed.

Predictions using higher-resolution ECMWF wind data, refined boundary layer depths and stability parameters, and RDM ADPIC were much better than the real-time predictions. The symposium presentation will demonstrate the significance of these factors to the accuracy of our predictions.

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